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(David R. Burns)

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APPLICATION FOR U.S. LETTERS PATENT

Title:

IONIZATION ANTENNA

Inventor:

Phillip Kaufman

David R. Burns - 46,590
LAHIVE & COCKFIELD, LLP
28 State Street
Boston, Massachusetts 02109
(617) 227-7400

IONIZATION ANTENNA

Field of the Invention

5 The present invention relates generally to weather modifications and more particularly to methods and systems for electrifying the atmosphere with ion emissions to modify weather conditions.

Background of the Invention

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Weather modification technologies have been developed to lessen the weather adversities of drought, dense fog, forest fires and severe storms by altering the level of ionization in the atmosphere to safely produce rain or snow in target areas. Traditional weather modification technologies utilize cloud seeding methods in which ice-forming
15 substances, such as silver iodide, lead iodide, dry ice, etc., are delivered to the cloudy medium in order to create artificial precipitation. The traditional cloud seeding methods emit chemicals into the atmosphere and are dependent upon the presence of clouds to produce weather modifications.

Recently developed weather modification techniques include Electrification of
20 the Atmosphere (ELAT) technologies. ELAT technologies utilize ground stations that release a flow of ions into the atmosphere and do not require emission of chemicals nor dependence upon the presence of clouds to produce weather modifications such as: inducing or inhibiting precipitation, increasing or decreasing relative humidity in order to help in controlling forest fires or to disperse fog, inducing changes to aid in
25 controlling violent storms such as tornadoes and hurricanes, increasing or decreasing temperature and changing wind speed and direction.

One example of an ELAT system is shown in Russian Patent No. 2,060,639, which discloses an ELAT system for creation of a volume charge in the atmosphere. The disclosed ELAT system includes an electrode in the form of a straight line of thin
30 wire, and a high voltage source. The system protects an area from precipitation, clouds, thunderstorms, fog or hail by creating a volume charge in the atmosphere to influence

cloud cover above the area. Accordingly, the capacity of the system, that is, the rate of generation of a volume charge, is proportional to the length of the wire so the wire is laid out in a substantially straight line for several kilometers. Alternatively, the wire is shaped to have one bend at a 90° angle or shaped in the form of the capital letter “T”.

5 Another example of an ELAT system is disclosed in Russian Patent No. 2,036,577, which discloses a method for protecting an area from cyclones. The method is implemented by producing a negative volume charge density in the area designated for protection about 1-20 days before the expected cyclone arrival. The negative volume charge diminishes or neutralizes the atmospheric positive volume charge associated with
10 the strengthening of the cyclone momentum.

 Still another example of ELAT technology is described in Russian Patent No. 2,100,923, which discloses a method for infusing electric charges into the atmosphere. Ions are released into the atmosphere to induce artificial precipitation. Aerosol particles are fused into a larger aerosol particles under the action of electric force which changes
15 polarity after predetermined intervals of time. The result is accelerated growth of the aerosol particles up to the size of a water droplet and then to the size of precipitation particles (i.e. raindrops).

 Conventional ELAT systems utilize a straight line, an “L” or a “T” shaped antenna to ionize molecules in the atmosphere. Unfortunately, the straight line shape,
20 the “L” shape, or the “T” shape antennas often exhibit an attenuation factor that reduces the efficiency of the ionization process because voltage is applied over the length of a continuous single strand of wire. Consequently, the antenna shapes of the conventional ELAT systems limit ion emissions into the atmosphere, and hence, limit its potential for weather modification. Furthermore, the conventional ELAT systems require a large
25 linear land area for operation, which limits deployment of such systems to selected geographical areas having sufficient linear land area.

 Therefore, there is a need for a system for ionizing molecules in the atmosphere that increases efficiency of ionization as compared to the conventional straight line or “L” and “T” shaped antennas and, in turn, uses less linear land area to realize weather
30 modification.

Summary of the Invention

5 The present invention provides methods and systems for modifying an ionization level in the atmosphere to effectuate weather modification. The methods and systems of the present invention utilize an antenna having an inner portion in electrical communication with an outer peripheral portion for efficient and optimal atmospheric ionization. The structure of the antenna yields an attenuation factor considerably less than the ones in a conventional single straight line, "L" or "T" shaped antennas, thus
10 increasing efficiency of ion emissions from the antenna. In addition, the more compact shape of the antenna minimizes the area required for effectiveness.

The antenna of the present invention enhances the ability to broadcast ions into the atmosphere. This antenna also increases the efficiency of producing vertical updrafts (for inhibiting precipitation) or downdrafts (for enhancing precipitation).

15 The antenna for broadcasting or releasing ions into the atmosphere comprises a central node coupled to a number of peripheral nodes by a conductive element such as, a wire or cable. At each peripheral node, the conductive element couples that peripheral node to the central node in a radial fashion. The conductive element is also coupled to adjacent peripheral nodes forming conductive peripheral spokes. The antenna further
20 includes a support structure to support the central node and each peripheral node. All nodes of the antenna are electrically isolated from the support structure of the antenna so that the conductive element conducts electricity. The support structure of the antenna includes vertical peripheral members to support the peripheral nodes of the antenna and a vertical central member to support the central node. The shape of the antenna is similar
25 to an inverted cone. Electric power is applied to the conductive element to release a flow of ions into the atmosphere.

The present invention beneficially reduces the size of the antenna to produce ELAT weather modifications and, in turn, the amount of land required for such an antenna. The reduced size of the antenna also simplifies the installation and maintenance
30 of the antenna in the present invention.

Brief Description of the Drawings

FIGURE 1 is a block diagram of a system for efficiently and optimally
5 electrifying and ionizing molecules of the atmosphere;

FIGURE 2A is an illustrative depiction of ions and water molecules;

FIGURE 2B is an illustrative size comparison of a rain drop, a cloud droplet and
a condensation nucleus;

FIGURE 2C is an illustrative depiction of aerosols;

10 FIGURE 2D is an illustrative depiction of raindrops;

FIGURE 3 is a perspective view of an exemplary antenna suitable for practicing
the present invention; and

FIGURE 4 is an exemplary flow chart that provides an overview of the method
for electrifying and ionizing molecules in the atmosphere in the present invention.

15

Detailed Description

The present invention concerns methods and systems for modifying weather
conditions by modifying an ionization volume in the atmosphere. An antenna having a
20 center portion electrically coupled to an outer peripheral portion framed around the
center portion is employed to increase or decrease the ionization volume in the
atmosphere. The antenna minimizes the attenuation which reduces ionization efficiency
as a voltage is applied to the antenna, and therefore, the antenna efficiently and
optimally modifies the ionization volume in the atmosphere. The antenna further
25 reduces the amount of land required to construct such an antenna.

FIGURE 1 is an exemplary block diagram of a system for electrifying and
ionizing the atmosphere in accordance with the present invention. The system 100
includes an antenna 110, a power source 130, and a control unit 140. The system 100
can further include meteorological data 120 providing weather data and images. The
30 antenna 110 is exposed to the atmosphere 150 to modify a volume of charge in the
atmosphere 150. System 100 can further include a measurement device 121, for

example an E-field probe, for measuring an intensity of the electric field in the atmosphere 150 in the vicinity of the antenna 110.

The power source 130 provides electric power to the antenna 110. The power source 130 is coupled to the antenna 110 to create a flow of current through the
5 conductive elements of the antenna 110. In this manner, when an electrical current flows through the conductive elements the antenna 110 emits a stream of charges into the atmosphere 150 to create an electric field and, in turn, positively or negatively charge the atmosphere. The electric power supplied to the antenna 110 by the power source 130 is DC (direct current) with voltages ranging from about -300KV (kilovolts)
10 to about +300KV (kilovolts) and current ranging from between about 0 to about 50 mA (milliamperes). One suitable voltage value and current value for operating the antenna 110 is about 150KV and 15 mA. The structure of the antenna 110 will be described below in more detail with reference to FIGURE 3.

FIGURES 2A-2D depicts the progress of the water molecules to raindrops in the
15 atmosphere 150. FIGURE 2A is a representation of ions and water molecules bonded together. In the atmosphere 150, ions bond with water and, possibly, other molecules to form condensation nuclei shown in FIGURE 2B. Traditional seeding methods attempt to modify weather conditions by releasing substances such as silver iodide and other substances into the atmosphere using aircraft or ground stations. In the illustrative
20 embodiment, the ions are introduced into the atmosphere 150 to create the condensation nuclei. No chemicals are introduced into the atmosphere in the present invention. As such, the method and system of the present invention provides an environmentally friendly solution to weather modification without the need for potentially hazardous chemicals.

25 FIGURE 2B illustrates an exemplary view of the size comparison between a rain drop, a cloud droplet and a condensation nucleus. The raindrop at about 2 millimeter in diameter and is about a hundred times as large as the cloud droplet, which is about 0.02 millimeter in diameter, which, in turn, is about a hundred times as large as the condensation nucleus, which is about 0.0002 millimeter in diameter. Ions combine with
30 water molecules to form condensation nuclei, which attract additional water molecules in the atmosphere to create aerosols. FIGURE 2C illustrates an enlarged exemplary

view of aerosols. The aerosols continue to attract more water molecules, increasing in mass until raindrops are formed. FIGURE 2D illustrates an enlarged view of raindrops. The number of aerosol particles in a cloud controls the formation of water droplets. One of skill in the art will appreciate that the figures are illustrative examples to depict the progress of the water molecules to raindrops in the atmosphere and the present invention is not limited to the process of making precipitation. Rather, the present invention can apply to any process of changing weather conditions. For example, the present invention can be applied to all processes of weather modification because electrifying the atmosphere through ionization creates a number of weather parameter changes, which include among others, wind speed and direction, temperature, relative humidity and barometric pressure. Consequently, the present invention is well suited for use to inhibit precipitation, to help in controlling forest fires and even to diminish severe storm conditions.

As illustrated in Figure 1, meteorological data 120 provides weather data and images obtained from weather stations operational in the vicinity of the system 100 as well as from weather satellites. In this manner, the meteorological data 120 can provide an indicator of current atmospheric conditions and an indicator of predicted future atmospheric conditions. As such, use of the meteorological data 120 helps facilitate an increase or decrease in the emission of ions from the antenna 110 into the atmosphere 150 to accomplish the desired weather modification characteristics. Furthermore, the measurement device 121, in addition to or in conjunction with, can provide an input to the control unit 140 to control the power source 130, and, hence an ion volume charge in the atmosphere 150. Measurement device 121 provides an indicator of electric field intensity in the atmosphere 150 at varying distances from the antenna 110. The control unit 140 controls the power source 130 based on a signal from the system operator, which is the result of a decision made based on analysis of the meteorological data 120, and data from measurement device 121 to ionize the atmosphere 150 to the desired level.

FIGURE 3 depicts a perspective view of an exemplary antenna of the present invention. Antenna 110 has an inverted cone-likeshape and the outer perimeter or base of the antenna has a polygon-like shape, in this case hexagonal. The antenna 110 includes a central node, peripheral nodes, radial spokes 241 through 246 and peripheral

spokes 231 through 236. The central node is located near the center of a polygon base 220 and includes a central tower section 210 installed on a central foundation section 211. The peripheral nodes are located at the vertices of the polygonal base 220 and include peripheral posts 221 through 226 that are installed on peripheral foundations 251
5 through 256. The central tower is approximately equidistant from all peripheral nodes. The radial spokes 241 through 246 connect the peripheral nodes to the central node. The peripheral spokes 231 through 236 connect each of the peripheral nodes to the adjacent peripheral nodes. The hexagon base 220 is an illustrative embodiment of the present invention and one of skill in the art will appreciate that the shape of the base 220 can be
10 other polygons. For example, the polygon base 220 may be a triangle, a square, a rectangle, a pentagon, etc.

There is a central node near the center of the hexagon base 220 that includes a central tower section 210. The height of the central tower section 210 varies depending on the number of angles in the polygon base. As the number of angles in the polygon
15 base 220 increases, the height of the central tower section 210 decreases. The relationship of height of the central tower section 210 to the number of angles in the base portion is represented below in Table A. Those skilled in the art will recognize that Table A is provided as merely a reference and that the overall total length of the conductive element or wire can vary depending on the area of land available, the size
20 and shape of the antenna and other factors. For example, Table A reflects an overall total conductive element length in the area of forty-five hundred feet, but the dimensions in Table A are scalable, up or down, to accommodate an increase or decrease in the overall total length of the conductive element. One overall total length of the conductive element suitable for practicing the illustrative embodiment of the present invention is
25 about seventy-five hundred feet. Nevertheless, those skilled in the art will recognize that the overall total length of the conductive element varies based on terrain topography and the amount of land available to deploy the system and antenna of the present invention.

Table A

Number of Angles	A (Feet)	B (Feet)	C (Feet)	D (Feet)	Area (Acres)
3	140	480	831	4,509	16.5
4	130	470	665	4,813	15.8
5	130	460	541	4,908	15.1
6	130	450	450	4,919	14.5
7	120	450	390	4,985	14.5
8	120	440	337	4,934	13.8
9	120	430	294	4,874	13.2
10	120	430	266	4,917	13.2
11	110	420	237	4,816	12.6
12	110	410	212	4,742	12
13	110	410	196	4,775	12
14	110	400	178	4,702	11.4
15	100	400	166	4,682	11.4
16	100	390	152	4,603	10.9
17	100	380	140	4,527	10.3
18	100	380	132	4,558	10.3
19	100	370	122	4,485	9.8
20	90	370	116	4,431	9.8

“A” is the approximate height of central tower section.

5

“B” is approximate distance of radial spokes.

“C” is the approximate distance of peripheral spokes.

“D” is approximate total wire length.

10 The central tower section 210 can be constructed on a central foundation section,
for example approximately 40 x 40 x 80 (inches) concrete slab, depending on the terrain
and local requirements. The central foundation section secures the central tower section

210 in a vertical direction. Exemplary fasteners to couple the central tower section 210 to the foundation section include bolts, screws, various steel bars (with and without threads), and other suitable fasteners.

5 The central tower section 210 may be constructed using commercially available antenna tower sections, such as freestanding tower sections available from Rohn Industries, Inc., or other suitable supplier. Typically the central tower section 210 is around 100 feet high, and the height of the tower section 210 will vary depending on the type of polygon base, as shown in Table A above.

10 The central tower section 210 can include a winch mechanism that can hoist the radial spokes 241 through 246 connected to the tower section 210 up to an operating position. The winch mechanism can also lower the radial spokes 241 through 246 to a ground level and allow antenna installation and maintenance to be performed at the ground level. Any of various mechanisms or instruments that can raise and lower the radial spokes connected to the tower section can be used as the winch and one of skill in
15 the art will appreciate that the winch mechanism can include manual and automatic winch mechanisms.

 At the vertices of the hexagon base 220, there are peripheral nodes that include peripheral posts 221 through 226. The peripheral posts 221 through 226 are mounted on peripheral foundations, for example concrete slabs, or other suitable foundations. The
20 peripheral posts 221 through 226 may be implemented using three inch diameter plastic pipes. The plastic pipes are exemplary for the peripheral posts 221 through 226 and one of skill in the art will appreciate that the posts 221 through 226 are not limited to PVC pipes and can be implemented by other material, for example, steel, fiberglass, graphite, or other suitable material composition.

25 The height of the peripheral posts 221 through 226 is lower than that of the central tower section 210, for example about 25 to 30 feet high. The height of these peripheral posts 221 through 226 provides sufficient clearance within the antenna 110 to allow equipment, such as farm equipment, to be used within its inner perimeter of the base portion of the antenna 110. This configuration of the antenna 110 maximizes the
30 usage rate of the land where the antenna 110 is installed.

The peripheral posts 221 through 226 are configurable to include a winch or pulley system that can lower a portion of the radial spokes 241 through 246 and the peripheral spokes 231 through 236 connected to the peripheral posts 221 through 226 to a ground level and allow antenna installation and maintenance to be performed at the ground level. The pulley or winch mechanism includes any of various mechanisms or instruments that can raise and lower a portion of the radial spokes 241 through 246 and the peripheral spokes 231 through 236 connected to the peripheral posts 221 through 226.

The peripheral spokes 231 through 236 connect each of the peripheral nodes to the adjacent peripheral nodes and the radial spokes 241 through 246 connect the peripheral nodes of the polygon base 220 to the central node. The length of the peripheral spokes 231 through 236 and the radial spokes 241 through 246 varies depending on the number of angles in the polygon base 220. As the number of angles in the polygon base 220 increases, the length of the spokes decrease. The approximate length of the spokes is specified in Table A above. One of skill in the art will appreciate that although the above description was for peripheral spokes which form an outermost peripheral ring, there could be any number of concentric rings that could be laid out from the central node out to the peripheral nodes between the fiberglass isolator bars at either end of the radial spokes, forming a lattice similar in shape to a spider web.

The peripheral spokes 231 through 236 and central spokes 241 through 246 consist of a steel cable or wire, for example solid stainless steel wire or stranded stainless steel wire or cable, which is approximately 20 mils or 1/50th inch in diameter. The cable is connected to the power source 130 and provided with electric power therefrom. The solid stainless steel cable and the stranded stainless steel cable are exemplary wires for implementing the peripheral spokes 231 through 236 and the radial spokes 241 through 246. One of skill in the art will appreciate that the peripheral spokes 231 through 236 and the radial spokes 241 through 246 are not limited to the stainless steel cable or wire, solid or stranded, and can be implemented by other types of solid or

stranded wire or cable, for example, copper or aluminum. Similarly, one of skill will appreciate that the diameter of the cable is not limited to a 20 mil dimension and that other dimensions are suitable for practicing the present invention.

5 The radial spokes 241 through 246 are connected to the central tower section 210 through insulating fiberglass bars 250G through 250L at the central tower section 210. The insulating bars 250G through 250L not only insulates the radial spokes 241 through 246 from the central tower section 210 but also reduce the potential canceling effect of adjacent coronas surrounding each of the radial spokes 241 through 246 at the central tower section 210. The other end of the radial spokes 241 through 246 are connected
10 directly to the peripheral spokes 231 through 236, since there is minimal corona canceling effect because the angles approach 90 degrees so that the junction acts very much like a "T" junction. The peripheral spokes 231 through 236 are also connected to the peripheral posts 221 through 226 through insulating fiberglass bars 250A through 250F.

15 FIGURE 4 is a flow chart that illustrates a method for electrifying and ionizing molecules of the atmosphere in the illustrative embodiment of the present invention.

In Step 310, an antenna is provided. The antenna has a central node that includes a central tower section 210. The height of the central tower section 210 varies depending on the number of angles in the polygon base. As the number of angles in the
20 polygon base 220 increases, the height of the central tower section 210 gets lower, as shown in Table A above. The central tower section 210 optionally includes a winch mechanism that raises and lowers the radial spokes 241 through 246. The central tower section 210 includes isolator bars 250G through 250L for isolating the radial spokes 241 through 246 from the central tower section 210.

25 Peripheral nodes are located at the angles of the polygon base 220. The peripheral nodes include peripheral posts 221 through 226. The height of the peripheral posts 221 through 226 is lower than that of the central tower section 210. The height of these peripheral posts 221 through 226 is determined to enable various farm equipment or other equipment to be used inside the perimeter of the antenna 110. The peripheral
30 posts 221 through 226 optionally include winch systems similar in the central tower section 210. The peripheral posts 221 through 226 include electrical isolators 250A

through 250F for isolating the peripheral spokes 231 through 236 and the radial spokes 241 through 246 from the peripheral posts 221 through 226. One of skill in the art will appreciate that the number of posts are illustrative and can vary depending on the number of angles in the base polygon, as shown in Table A. Moreover, those skilled in the art will recognize that isolator bars 250A through 250L are formed from a material or composition having suitable non-conductive properties, for example fiberglass, and can take a number of suitable cross-sections, including circular, spherical, square, rectangular and the like. The isolator bars could be any shape that permits the spokes to be isolated from the central or peripheral posts.

Each of the peripheral nodes is connected to the adjacent peripheral nodes to establish the peripheral spokes 231 through 236. The peripheral nodes are preferably connected to the central node to establish the radial spokes 241 through 246. The peripheral spokes 231 through 236 and the radial spokes 241 through 246 consist of an energy conductive material such as a steel cable, for example, solid stainless steel or stranded stainless steel wire or cable. The radial spokes 241 through 246 are connected to the central node through isolator bars 250G through 250L in the central tower section 210. In a similar manner, the peripheral spokes 231 through 236 are connected to the peripheral nodes at the peripheral posts 231 through 236 through the isolators 250A through 250F.

In Step 320, power is supplied to a peripheral spoke, electrifying all the peripheral spokes 231 through 236 and the radial spokes 241 through 246. The power source 130 can include a voltage generator assembly supplying a DC current to the antenna 110, which, in turn, induces the antenna 110 to emit ions into the atmosphere.

In step 320, the power source 130 is controllable based on the meteorological data 120 received by meteorological stations in the area of the antennas 110 and other areas to optimally ionize the atmosphere 150. As a result of suitable ionization, the water molecules and particles in the atmosphere 150 interact to enhance or inhibit precipitation.

The present invention results in more efficient and optimal ionization of volume charge in the atmosphere. The configuration of the antenna contributes to the efficiency of producing an updraft (for inhibiting precipitation) or a downdraft (for enhancing

precipitation) of ions in the atmosphere. The antenna of the present invention requires a smaller amount of land than an antenna formed of a substantially straight single long wire strand, or an "L" or "T" shaped antenna and further increases ionization and power efficiency by reducing an attenuation factor known to reduce ionization. Also, the

5 present invention simplifies installation and maintenance of the antenna due to the smaller distances involved. Furthermore, those skilled in the art will recognize that the present invention is well suited to modify a number of conditions including, but no limited to, inducing precipitation; inhibiting precipitation; increasing or decreasing

10 relative humidity in order to help in controlling forest fires or to disperse fog; inducing changes to aid in controlling violent storms such as tornadoes and hurricanes; increasing or decreasing temperature; and changing wind speed and direction.